



Navy Medicine Technology Watch: Concepts of Operations

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Summary

Objectives

The objectives of the present work were to (1) develop an informational Tech Watch Web site or service for Navy Medicine that tracks emerging commercial-off-the-shelf (COTS)/government-off-the-shelf (GOTS) technologies and those in development, and (2) integrate the Tech Watch service with relevant Navy entities such as the Naval Warfare Development Command (NWDC) and Fleet Forces Command (FFC) to support a cohesive transition strategy that leverages current military medicine information management/information technology (IM/IT) enterprise solutions.

Approach

Naval Health Research Center (NHRC) develops and tests field medical technologies and receives requests for information on emerging technologies from individuals and organizations within the Department of Defense (DoD) seeking solutions. These requests were used to pilot test the feasibility and utility of delivering brief, rapid turnaround investigative reports to customers. Initial reports were based on investigations by subject matter experts (SMEs) using available Internet search engines. The primary long-term goal for NHRC was to develop a specialized search engine and database for military medical technologies. This would provide a semi-automated, Web-based tool to support recent initiatives for a Navy-wide medical requirements process at NWDC and FFC. The Office of Naval Research (ONR) and Office of the Chief of Naval Operations (OPNAV N931) requested that NHRC work to integrate its Tech Watch project within the combat development process. NHRC placed a liaison at NWDC/FFC to facilitate this work.

Results

NHRC delivered several investigative reports to customers such as Third Fleet, which led to shipboard testing of selected products. A concepts of operations (CONOPS) for a Web-based search tool was proposed to monitor COTS/GOTS and emerging medical technologies, including four components of a dynamic process: (1) gathering information based on keyword searches for particular technologies, (2) filtering the information for relevance and duplication, (3) reporting the results of searches to relevant users, and (4) extending the service to include new keywords

and new technologies based on user feedback. This would initiate additional gathering of new information. A prototype search tool and database have been developed based on keywords. Additional work would need to develop a Web-based interface and user database and adapt use of recent artificial intelligence methods to permit semantic search and filtering capabilities. The Navy medicine requirements process is still under development at FFC; therefore, integration of the NHRC Tech Watch service is pending.

Conclusions

NHRC received positive feedback from customers receiving technology investigative reports responding to their specific informational requests. A dedicated service and/or Web-based application to support these requests appears feasible with potential utility. A plan to develop an informational Web site including an accessible search tool and database for Navy Medicine technologies was established. However it is difficult to integrate this product within Navy medicine at the present time because the transition of medical products in the combat development process is under review at FFC and NWDC. An additional factor is the requirement to synchronize disparate commands into a streamline material solution acquisition process. The Defense Medical Standardization Board (DMSB) is initiating a joint medical solution to acquire standardized medical materiel solutions to meet all services requirements. The utility of efforts such as the ONR tech solutions project, a Web-based solution for collecting and responding to nonmedical technology requests, suggests that a similar medical effort such as the NHRC Tech Watch project would add value to the development of military medical technology solutions.

Introduction

The objectives of the present work were to (1) develop a comprehensive informational Web site or service designed to track emerging COTS/GOTS medical technologies for the military medical community and those in development, and (2) support a cohesive transition strategy that leverages current military medicine Information Management/Information Technology (IM/IT) enterprise solutions. Ideally, this would align major Navy medicine stakeholders in requirements identification, priority of research and development efforts, and technology/product transition through the combat development process and acquisition.

This report summarizes the overall concepts of operation planned for the project. Current status is (1) an investigative process has been developed and initial reports on COTS/GOTS technologies have been delivered to customers such as Third Fleet and ONR,¹⁻³ (2) a prototype Internet search engine tool, introducing novel, semi-automated search techniques, has been developed, and (3) future plans for transitioning the service to a Navy customer or a Web-based application are pending.

In 2005, both NHRC and NWDC were engaged in efforts related to naval medical requirements. OPNAV N931 tasked NHRC to integrate the development of its technology information or Tech Watch project with the Navy requirements process under development at NWDC. NHRC and NWDC goals were to develop and leverage the best technology for Navy and joint medicine dependent on the ability to identify operational and system requirements (both service and joint), and provide information for the medical end user to ensure the technology is developed within the three DoD decision support systems (Requirements Generation System, Defense Acquisition System; and the Financial Management Systems).

NHRC proposed a Navy medical technology Web-based system called the Navy Medical Technology Watch (NMTW) that incorporates the tenets of the Navy line's combat development plan, SEA POWER 21, SEA TRIAL process, and the Concept of Naval Force Health Protection for the 21st Century (NFHP-21). NMTW is a collaborative effort between NHRC and NWDC.

To accomplish this task, NHRC provides medical and technical expertise to establish procedures, design, develop, and maintain the NMTW Web site, and provides subject matter experts (SMEs) to investigate and respond to submitted user feedback. NHRC investigates and evaluates current GOTS/COTS medical technologies used elsewhere in the medical communities

to provide the requesting end user with medical product information that may further enhance health care capabilities.¹⁻³

Navy Medical Technology Watch Components

NMTW can provide a Web-based extension of ONR's current Technology Solutions project. ONR's Tech Solutions focuses primarily on nonmedical issues. The NMTW Web site(s) will be able to investigate user recommendations and current COTS/GOTS technologies as to their feasibility in addressing current Navy Medicine requirements. Furthermore, a systematic technology review will allow for development and modification of those technologies that do not readily fit within operational naval medicine requirements. NMTW would provide a venue for Navy, joint service, and civilian health care professionals to submit their ideas and have input on medical technologies they may utilize in the future. The following references provided background for the current development effort.⁴⁻¹³

The NMTW structure has four main components: gather information, filter the results, and save report new technologies, and extend the service (Figure 1).

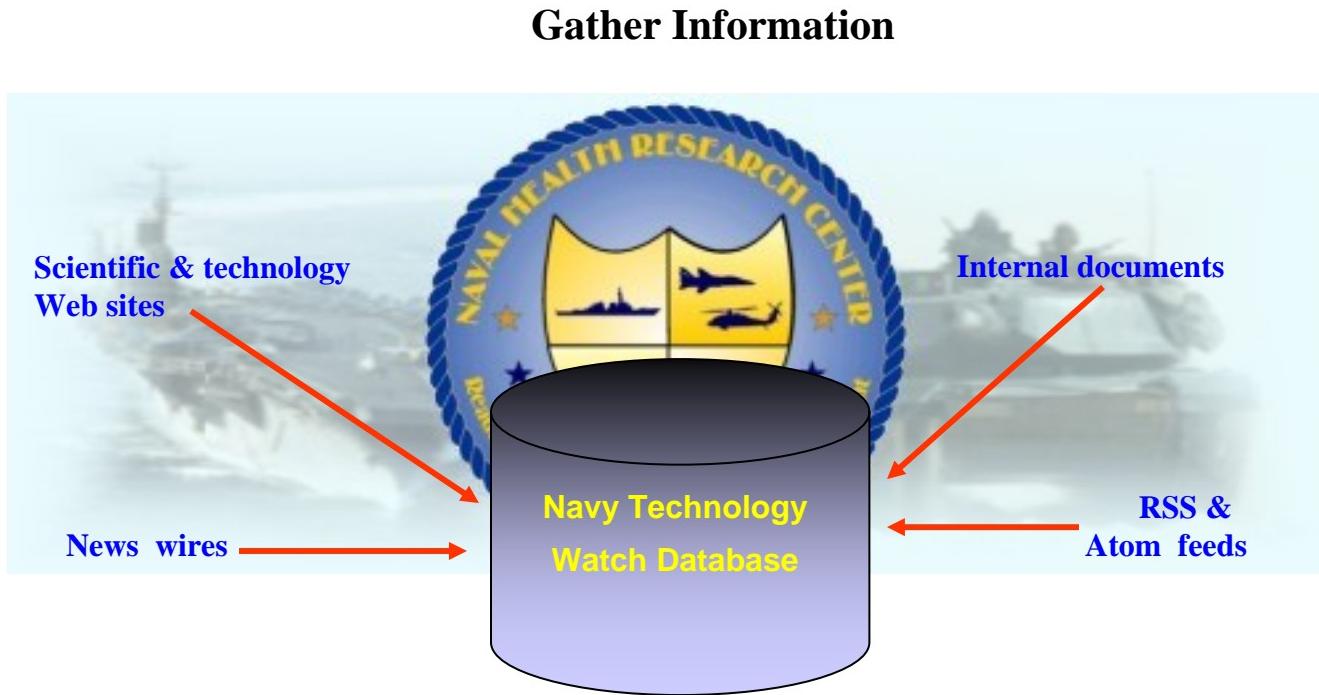
Figure 1

Principal Components of the Navy Medical Technology Watch Process



Figure 2

Primary Inputs to the Navy Medical Technology Watch Database



1. Gather Information. NMTW gathers information from multiple processes that populate the database and then categorizes the information into relevant subject headings. NMTW compiles information from the following:

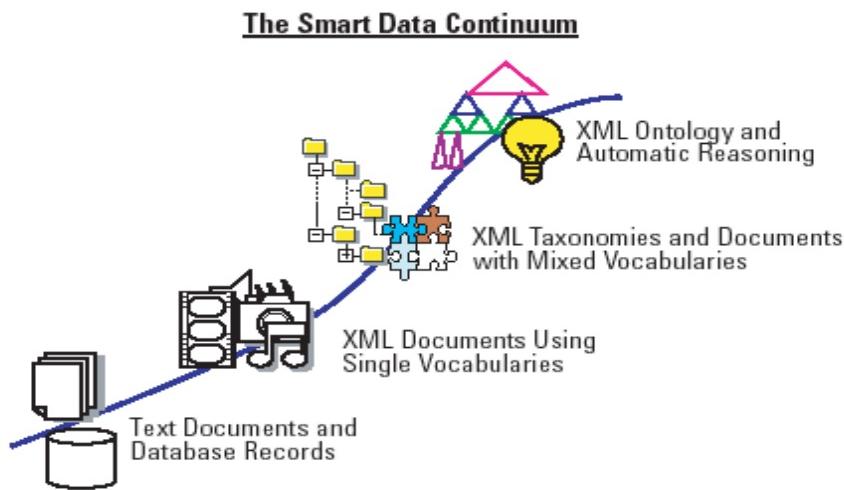
- *News wires* – The news wires provide direct feeds to syndicated news agencies such as the Associated Press (AP) and United Press International (UPI). News wires provide information regarding technologies that describe current as well as ongoing research. The advantage of gathering this information is the proactive approach. Users will have advanced information of emerging technologies prior to formal publications that usually occur after thorough research efforts. In addition, users can decide whether these technologies are worth the effort in stake-holding and therefore are at the forefront in advancing medical capabilities at established medical treatment facilities or in the field of deployment.

- *Scientific and technology Web sites* – Scientific and technology Web sites like Scientific American, New Scientist, MIT Technology Review provide definitive data and information related to established technologies and concepts. The advantage of this information is its potential to resolve medical technology or health procedural inadequacies in a relatively short period of time. Also, promoting awareness of new products and procedures avoids duplication of effort when the government may be considering a similar development project. NMTW gathers information for inclusion into the database and Web site using two primary procedures.
 - Providing updated and related hyperlinks that will allow the user to search for information outside the confines of the NMTW Web site
 - Daily proactive search of publications and articles by NMTW staff and SMEs of relevant medical technology as well as technology that could adjust to or benefit the military medical community
- *Internal documents* – Internal documents like proposals, investigative reports, guidelines, and procedures are generated by NMTW staff and user interaction. Proposals are submitted by the user and are presented for discussion and an evaluation of feasibility and cost analysis. In addition, proposals are presented as an informal process of peer consensus specific to a medical technology or solution.
 - Investigative reports are generated by user request. Often, users have a specific interest regarding a particular medical technology or procedure. Furthermore, this specific technology or procedure will have a variety of solutions. NMTW presents all solutions in the form of comparative analysis that includes capability, pros and cons, cost analysis, manufacturer with point of contact, and all applicable references. These investigative reports assist the user and/or stake-holders in developing an informed decision regarding the direction these specific technologies may proceed in the military medical environment.
 - Guidelines and procedures are provided for the user to have a basic understanding of the process with regard to research and development

(R&D) and acquisition of new technologies. NMTW provides three user methods to attain applicable information:

- Current and widely utilized military directives can be accessed within the NMTW Web site. Any classified information would be maintained on a copy of NMTW on the Secret Internet Protocol Router Network or SIPRNET.
 - Related hyperlinks to DoD Web sites that contain additional and specific directives can be accessed from the NMTW Web site.
 - Hyperlinks to DoD research facilities to determine if specific technologies are already within the system.
-
- *RSS and Atom* – These are relatively new methods of dispersing news items. Most scientific publications now provide their stories in Rich Site Summary (or Really Simple Syndication) -- (RSS) or Atom format. RSS and Atom were developed to provide up-to-date information automatically from Web sites. Many news Web sites support this innovation. For example, in relation to news Web sites, a user can customize his/her query or interest by specifically requesting all up-to-the-minute news for a particular subject or section within the Web site so it may be forwarded via e-mail to the user's account. As a result, the user can receive all news related to a specific topic, for example "laser surgery," from the Web site or, more specifically, all application-specific news(e.g., LASIK). NMTW provides this process on two levels:
 - NMTW integrates this technology to receive advanced news items regarding technologies and health procedures that populate the database. It can allow the medical community to anticipate and prepare for enhancements in the field of medicine.
 - The process allows the user to customize a query that will forward via e-mail all articles and/or periodicals related to a specific technology of his/her interest.

2. Filter the Results. Filtering the results or data is a key component of NMTW. Due to the large amount of information available on the Internet and the number of sources involved, the likelihood of trivial or noncontextual information is high. **Relevance ranking** and **elimination of duplication** are performed here. These steps represent a semi automated means of intelligent and efficient data storage saving the user time with unnecessary information. The continuum of increasing intelligence that can be built in to the data acquisition and storage process now as illustrated in Figure 3 below.



The trend is to put the "smarts" in the data, not in the applications.

Figure 3

- Relevance ranking – This step currently is performed manually. As NMTW grows and evolves, integrating and using an artificial intelligence technique can enhance the process more efficiently. This process searches and evaluates the relevance of news stories in relation to technology and determines its beneficial relevance within the military medical environment and community. Finally, the process ranks them accordingly. Items with low relevance are discarded.
- Relevance ranking is a crude method used to determine where (e.g., title, text, abstract) the keywords appear and how often. For instance, an article containing the word “nano” could either relate to the field of nanotechnology, or the Apple iPod Nano (a music-playing device). Relevance ranking can be used to separate

the two types of articles in most instances, and to eliminate the low-ranking articles.

- Elimination of duplication – Utilizing RSS and/or Atom will inevitably generate duplicate or similar stories. Prior to populating the NMTW database, duplicate stories (i.e., when the New York Times and the Washington Post publish the same story) are discarded and only one article will be selected while more than one informative source will be noted.

Future enhancements as NMTW evolves will use language constructs and ontologies with semantic Web representation to ascertain the meaning and context of Web pages.

3. Report New Technologies. As discussed above, the process begins with how data are accumulated, then how the data are evaluated for pertinence. This process explains how the information is presented in the form of reporting. The information is divided into two basic presentations. Experience has shown that most news articles will report on a new technology. The actual application of the technology appears afterward. It is a simple technology versus application reporting presentation. These reports can manifest individually or NMTW can allow the user to proactively interact with the information by utilizing an interactive discussion board, often referred to as “blogs” to attain validity among peers. For example:

- New Technology – An article may describe the ability to embed solar power cells within fabric.
- Application – The user could then suggest using this fabric for ICU tents in the field to provide backup power to life support equipment during generator failure.
- Validity – The user attains consensus among peers.

Figure 4 below summarizes the Reporting process.

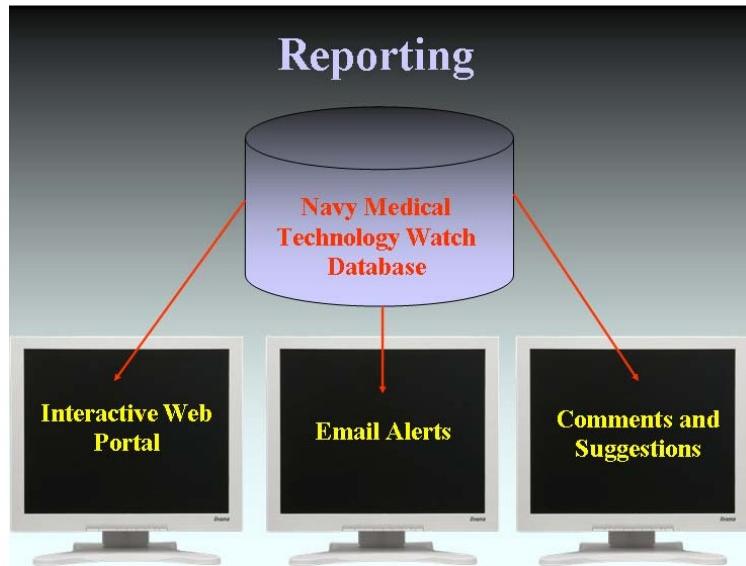


Figure 4

The **interactive Web interface** will allow users to search the NMTW database for keywords, and see all relevant stories. The user can limit the results based upon a range of dates, article type, or classification.

If a particular category (e.g., solar power or neural networks) is interesting, the user can request **e-mail notification** (an alert) when a new article appears within this classification.

NMTW will allow users to post comments and suggestions on articles, periodicals and publications on a discussion board, similar to online Web logs (commonly referred as “blogs”) and present them on the NMTW Web site.

4. Extend Service to Encompass New Terms, Technologies, and User Capability.

NMTW is dynamic. It will need to adjust to new technology and terms without infrastructure changes. In addition, NMTW provides the user a vehicle to post feedback comments to enhance Web site navigation and functionality of the product. For example, NMTW itself will need to offer RSS and Atom feeds that summarize the blogs.

As terminology and technologies change, the structure of NMTW will allow new topics to be tracked. For instance, nanotechnology terms now used include nanoshells, nanotubes, and

nanospheres. These terms did not exist prior to 5 years ago, and now are important keywords to determine whether nanotechnology was used within a new product.

During the Filter stage, new terms may be found that exhibit a high relevancy to an existing topic. These new semantic links can be easily added to the NMTW database to allow future searches to tag and collect articles containing the new keywords. This dynamic nature means that NMTW will constantly grow in scope and range of topics.

User feedback will enable NMTW to grow and evolve into a more dynamic and informative interactive Web site as well as an invaluable asset and tool for the military medical community.

Navy Medical Technology Watch Database

The database (presently MySQL) ultimately should operate with an Oracle Relational Database Management System for scalability and contains technological articles that can be accessed by keyword query. The database is organized into three parts:

- The first consists of current articles and periodicals actively sought and researched for inclusion into the database. These articles and periodicals consist of present and future medical technologies that are developed or under R&D globally and may have relevance within the military medical community. In addition, the latest technologies will be highlighted on the Web site and hyperlinked to the relevant article.
- The second contains recent investigational reports submitted by NHRC for review as a result of specific queries from users.
- The third contains archival periodicals and articles as well as NHRC reports and white papers that may be useful to the user. Subject headings are added to assist in navigating to relevant topics and can be easily recognized by users in the medical community.

The database and Web site are intended to be developed four phases:

- Phase 1 – The database is based on keyword queries. Both MySQL and Oracle provide text analysis tools to search for text keywords and relationships within items. Automated e-mail notification of the user's scheduled searches is provided.
- Phase 2 – Phase 2 will add a Web interface to input keywords for automatic daily updates. If a new product needs to be tracked, then the keyword would be placed

in the list and stories would automatically begin accumulating on the new product or technology. This will help address the static keyword list by making it somewhat dynamic. Automatic updates will be forwarded to the user by e-mail. In addition, a blog, will be developed during this phase.

- Phase 3 – In Phase 3, the keyword list will interface with Google, Yahoo, and other search engines.(e.g., utilize existing search engines to search for all Web pages that reference a specific technology such as “nanotechnology” in the page title). The Internet is not static and new sites pop up every day. For each keyword, a list of Web addresses (URLs) will be stored from the last search engine query. The number of times a particular site uses the keywords will automatically rank the site’s pertinence.
- Phase 4 – Phase 4 will include development and use of a set of statistical analysis tools to build the keyword lists based on relevance. These data-mining and text-mining tools help find data. These tools can be used on a body of knowledge to see changing trends and new technologies. This refers specifically to artificial intelligence (neural networks, genetic algorithms) and statistical analysis of the text. In addition, these tools will help recognize new areas for project work/requirements and new technologies, which may be applicable to current projects.

Administrator Functionality. To avoid user mistakes and abuse, the administrator will have the ability to grant access, and to vet input from users to insure accuracy, pertinence, and medical technological focus. The administrative capabilities will be performed by NHRC staff and contractors who have expertise in the fields of medical technology, health care and medical informatics, and include programmers, database administrators, Web developers, and engineers.

The administrator will have the following capabilities:

- Review medical technological queries submitted to the NMTW Web site
- Provide hyperlinks for user capability
- Review medical technology applicability to military operational medicine use and the potential operational environment/platform

- Determine pertinence of user keywords for searches of medical technology and health care procedure
- Evaluate trends among user inputs

Research and Review of Medical Technology Articles. The administrator will review and filters articles derived from specific keyword searches generated from the database. Often, as articles come in, despite the best algorithms, there will be duplications of the same material. As NMTW evolves, automated and specific keyword queries will be filtered and vetted reducing the need for manual administrative intervention.

Web Site-Generated Investigative and Research Medical Technology Reports. The administrator also will submit investigative reports generated from specific user requests. These reports will usually contain comparative analyses of similar technologies so the users may determine their capability and feasibility. The purposes of providing the investigative reports for the user other than specific requests will be to garner peer support that can ultimately lead to white papers, identification of stake-holders, research, and acquisition of particular medical technologies.

Military Medical Directives. NMTW users within the military medical community are on the “front lines” of health care and utilize the current medical technology. They have firsthand experience and knowledge of what is useful and what could be improved. Often solutions cannot be recognized due to the user’s lack of understanding regarding developmental and acquisition processes. NMTW will bridge this disconnect by maintaining applicable medical directives. The administrator will provide and maintain this capability for the user to ensure up-to-date and relevant directives are at their disposal. Only procedural directives relating to development and acquisition of the latest and/or advanced medical technologies and health care procedures will be provided. However, as discussed below, related hyperlinks for additional military directives will be provided for the user if the need arises.

User Preference and Profile. The administrator will maintain and update the relationship between the user’s area of interest and the application’s automated search capability. The user will be responsible for his or her preferences. The SME will validate information in the database and the engineering staff will maintain the capabilities. In the system developed as of this writing, the user function is maintained both manually and automatically. The manual

portion involves profiles submitted by the user at time of registration. The administrator will use this information for demographic analysis and customer service support. The former will assist the administrator in evaluating the overall customer base. As a result, NMTW will be able to modify its information gathering to target the primary customer base and/or widen its base by diversifying the information to fit the needs of a wider level of medical training and expertise. The latter will consist of forwarding specific articles of interest to the user via e-mail notification. The capability will be maintained by Web, database, and engineering staff. As NMTW evolves, customer support automation will expand and become more diversified to enhance performance and further fulfill the needs of the user.

User Feedback. User feedback will be one of the most important NMTW components because it provides the predominant portion of interaction between NHRC staff and the user. The administrators of this function must adequately respond, vet, investigate, and present pertinent information and requests from the user in a timely manner.

The ability of the administrator to effectively vet and respond to the user as well as maintain the feedback capability for the user will provide NMTW the following:

- White papers that could enhance medical technology
- Collaboration between the health care provider (user) and the technology development process
- Partnerships with medical commands
- Consultation regarding technologies and procedures
- Advance discussions on effectiveness of current military medical technologies between users and military medical authorities and/or policy makers.
- Related technical Web sites outside of usual medical technology Web sites
- Military Web sites that are authoritative and drive policy outside of the medical community
- Applicable technology and health-related DoD Web sites
- Armed Forces Web sites containing directives related to research and acquisition
- Armed Forces Web sites containing directives related to general military protocol
- Web sites related to advanced civilian technology in the field of medicine
- Web sites related to advanced civilian technology that could support, apply to, or cross over into the military medical environment

Web Log/Discussion Board. The main attribute of the NMTW discussion board will be to provide a relatively near real-time interactive discussion among peers. The NMTW administrator will monitor the discussion board for issues such as:

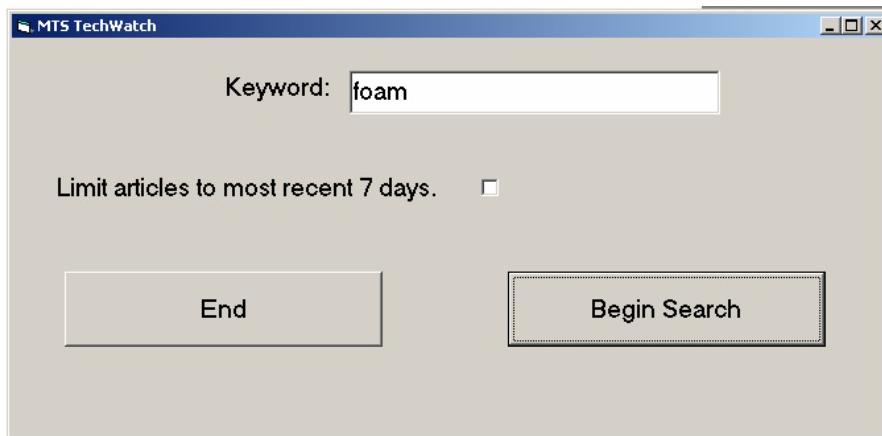
- Does the discussion remain on topic and is it relevant to the Web site's intent?
- When problems are presented are solutions or assistance given among peers? Does the discussion avoid privacy issues among peers?
- Does the discussion avoid classified information (not applicable for SIPRNET Tech Watch site)?
- Does the discussion avoid advertising or agendas?

User Functionality. The user will have the following capabilities:

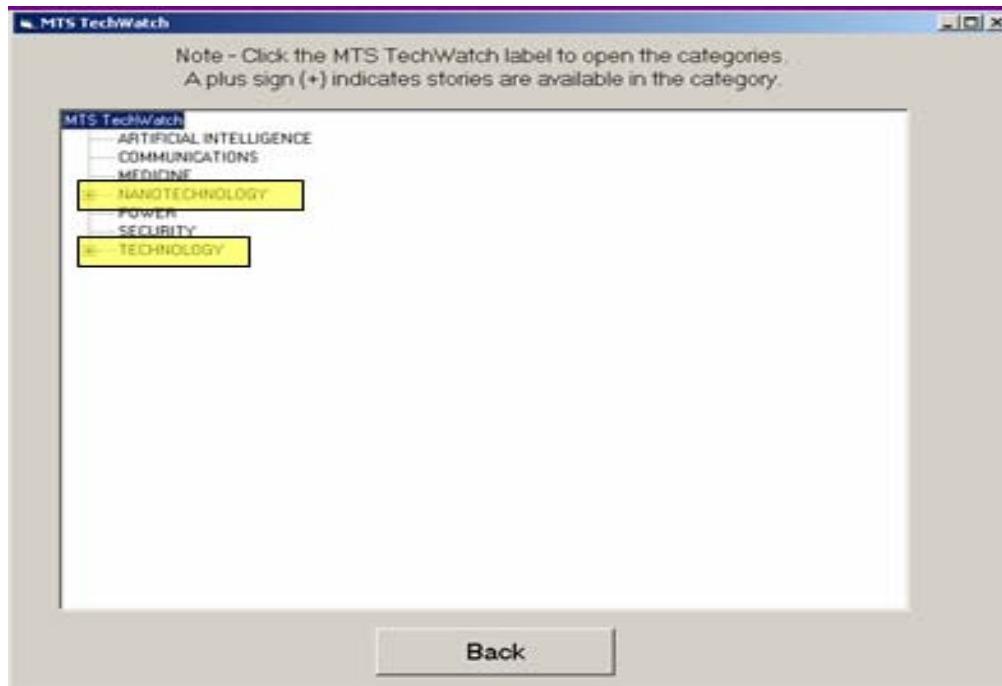
- Register with pertinent information such as name, rank, unit/command, and e-mail address.
- Review relevant articles based upon keyword queries.
- Create a "User Preference" specific to queries of interest.
- Submit medical technological issues for investigation by staff.
- Input recent technology use descriptions.
- Provide feedback regarding this Web site in order to enhance and improve functionality.

Keyword Query. The keyword query process is the standard procedure to search for relevant information by the user. Simple one word or multiple word queries allow the user to review articles contained on the Web site of his or her interest. Queries are based on article relevance and are ranked accordingly. The user can limit the results based on a range of dates, article type, or classification.

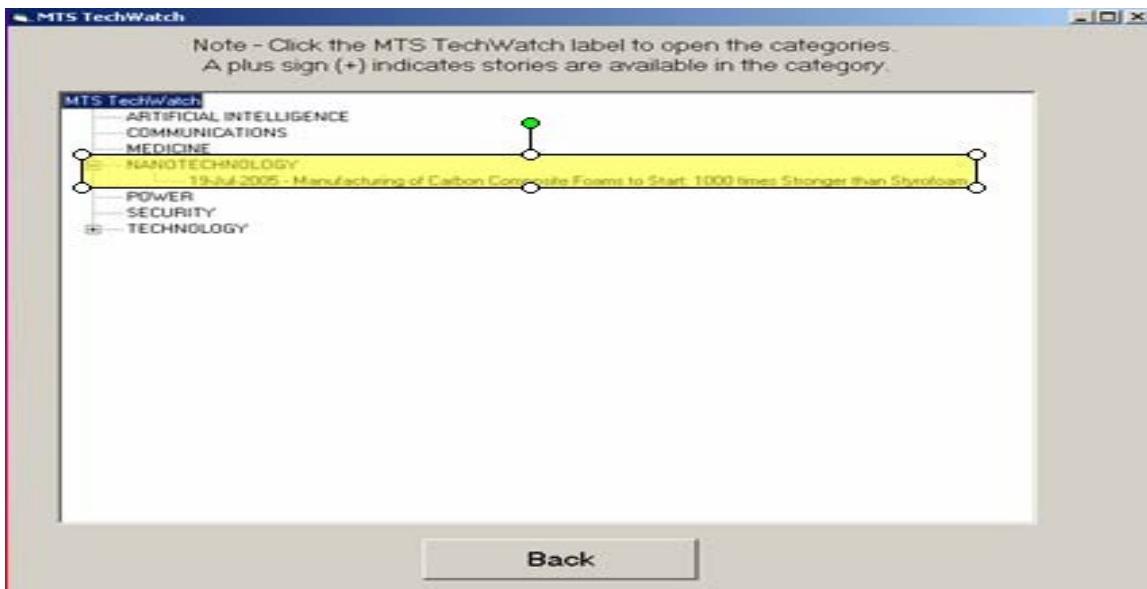
Initially the user will be asked for a keyword and if the articles should be limited to the most recent 7 days only:



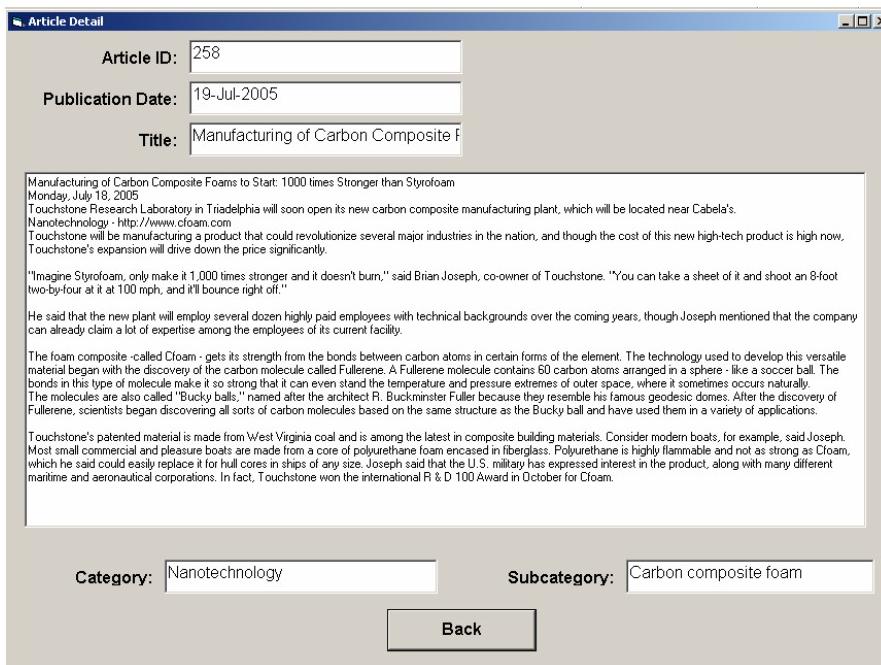
When the user selects a keyword (such as “foam” noted in previous figure), the database will be searched for articles containing this keyword.



The (+) sign indicates that an article with the keyword is available in both Nanotechnology and Technology categories. Clicking the (+) sign shows the article titles matching the keyword.



Clicking the article title will open a new window with the full article text.



User Preference. When users find relevant articles based on keyword query, they will have the option of creating a specific preference related to current query. For example, if a particular category (i.e., solar power or neural networks) is interesting, users will be able to request **e-mail notification** (an alert) when a new article appears within this classification. An

embedded hyperlink will be added to a utility on every article opened and read that allows users to submit pertinent information in order for the articles to be forwarded. Furthermore, as users receive daily articles based on initial query of interest, users will have the ability to discontinue e-mail notifications at the time the information is no longer of interest. A hyperlink will forward users to a “discontinue” utility located within the Web site. Upon discontinuation of this information, users will no longer receive articles related to that specific query.

User Feedback. Medical personnel in various positions will be able to input their own first-person view, questions, or information regarding current medical technology. NMTW will not solve medical technology issues; however, it will provide a tool that can support the user in finding an answer or process.

Hyperlinks. NMTW will also link to relevant military or civilian Web sites for the military health care professional to search for information regarding advanced technology and pertinent military directives. Thus, users may find information of interest within their keyword search query of NMTW articles, but may want to “drill down” to investigate further. NMTW’s related hyperlinks will provide the user with the following:

Web Log/Discussion Board. One of the most commonly used applications within a Web site is the blog or discussion board. This has become popular as a vehicle to comfortably present information or seek advice. The NMTW user may present or discuss specific advanced technological information relative to the medical community. The user will be able to assess whether a particular medical technology can gain consensus among peers and therefore advance the idea and the process of bringing it to the military medical community. For instance, the user may:

- Discuss current technology shortfalls and formulate solutions
- Submit articles for discussion

User Requests for Information – Investigative Reports. The NMTW effort may also include clinical SMEs to conduct investigative reports at the direction of the NHRC. Examples of these reports are referenced elsewhere.¹⁻³ They have been well received by customers such as the Third Fleet and ONR). A summary of investigative reports completed to date and processes involved are described by Snow et al. (under review as NHRC technical report). These reports contain the following elements:

- Origin of tasking and nature of technical information requested
- Key personnel
- Background information
- Technological or procedural information
- Relevant analysis of technology or procedure
- Comparative product analysis depending on task requirements
- Cost-comparative analysis, depending on task requirements
- Feasibility research
- Target user or organization
- References

Current Military Efforts. These existing and related efforts provide the end user a venue to recommend technology solutions, test medical equipment, and/or certify medical equipment that meets warfare platform certification (e.g., aviation).

Office of Naval Research Tech Solutions. The Tech Solutions Web site (<https://www.techsolutions.navy.mil>) is where Sailors and Marines can submit issues or ideas that impact their readiness and quality of service. Importantly, Tech Solutions receives mostly nonmedical requests, and therefore is a potential venue for the present NHRC medical Tech Watch effort to integrate and add value. Tech Solutions is an innovative, transformational business process created by the Chief of Naval Research and focused solely on rapid delivery of needed technology to the Fleet/Force. This is accomplished several ways:

- Technology search and analysis services
- Rapid prototyping of technologies to meet specific requirements
- Demonstrations of available technologies and conceptual systems

The goal of Tech Solutions is to provide Sailors and Marines Web-based access to the naval research enterprise. To be successful, Tech Solutions needs engagement and active involvement by the Fleet/Force. If a demonstration is performed or prototype is

developed, the submitter will always be involved in the process through final delivery of the technology.

Office of Naval Research's Commercial Technology Transition Officer (CTTO). The CTTO's mission is to rapidly transition the best technologies from any source into Department of the Navy programs (<http://www.onr.navy.mil/ctto/default.asp>). The CTTO transitions technologies that can be used or modified for Department of Navy use given they meet Technology Readiness Levels (TRLs) six to nine. The CTTO applies knowledge of a program's technology needs and a comprehensive understanding of technologies that might be of value to provide a solution. The CTTO seeks an ongoing understanding of naval needs by keeping in close contact with naval acquisition leaders and warfighters. This dynamic coordination helps the CTTO to identify solutions from any source — public or private, domestic, or foreign. The CTTO is involved with the technology insertion from beginning to end — from assessment of the basic technology to consideration of goals, funding, schedules, and testing through acceptance by the acquisition customer. As an active advocate for the rapid transition of technology to naval systems, the CTTO assists the acquisition community in identifying program executive office needs and possible technology solutions, and determines the user's situation and a desired end product before any discussion of a specific technology transition strategy occurs. The CTTO is currently looking for solutions in the following focus areas:

- Global War on Terrorism
- FORCEnet
- Power
- Sensing
- Autonomous vehicles
- Logistics

Naval Medical Logistic Command (NMLC). The NMLC Web site (www.nmlc.med.navy.mil) provides information on its Test and Evaluation program. The NMLC testing program was developed to allow the evaluation of medical/dental materiel in order to determine if the product meets the necessary requirements of the mission.

NMLC approval is required prior to accepting medical or dental material for testing. Their evaluation report may not be used as an endorsement of the item or in any advertisements by private industry. Once approved, the requestor is given a project number and the date that results are due to the NMLC office. The testing information is maintained in a local database.

United States Air Force Dental Evaluation & Consultation Service (DECS). DECS (<https://decs.nhgl.med.navy.mil>) is located at the Recruit Training Command, Great Lakes, IL, along with the Naval Institute for Dental and Biomedical Research and the US Army Dental and Trauma Research Detachment. The organization has been set up specifically to solve operational problems and to evaluate methods, equipment, and materials as identified by military dental activities and by the office of the Air Force Surgeon General.

DECS consists of four operational sections: Materials Evaluation, Equipment Evaluation, Facility Standards and Design, and Infection Control and Safety. DECS has evaluated hundreds dental products over the last several years and the results have appeared on its Web site.

Defense Medical Standardization Board (DMSB), COTS research testing and evaluation (T&E) program. DMSB was recently authorized to passively and proactively procure, test and evaluate technology for the purpose of introducing the latest medical technology in support of military medicine. DMSB is in the process of creating a division/department for the sole purpose of executing this project.

The DMSB planned process is as follows.

- DMSB will present a technology to all US Armed Forces via a to-be-determined Web site. Technologies will originate from passive queries originated from individuals, groups, and “lessons learned.” They can also come from a proactive

approach from DMSB based on identifying medical technology needs within the military that have been discussed but have not been addressed.

- Any Type Commander from any service interested in the technology will be given due consideration based on the level of “stakeholding” interest and capability. More than one major command can stake-hold a technology of interest and contribute budgetary funds to accomplish the T&E process.
- The T&E process is dynamic, meaning that the DMSB Test and Evaluation (T&E) Division will offer R&D T&E venues to participate in the process provided the appropriate infrastructure exists to accomplish the task. The reasoning is DMSB may not have the infrastructure or specialty to adequately and successfully T&E a specific medical technology of interest. The T&E funds for the project would be forwarded to the venue assigned.
- The COTS T&E process is envisioned to be a “JCIDS Lite” (Joint Capabilities Integration Development System). The process will revolve around the Initial Capability Document (ICD) protocol of JCIDS. Its purpose is to avoid the established program of record bureaucracy that exists with many existing GOTS technologies in the Armed Forces.

Marine Corps Systems Command (MARCORSYSCOM). The MARCORSYSCOM T&E process is completed through a Memorandum of Understanding with the US Army Aeromedical Research Laboratory (USAARL) to test medical equipment and determine required aviation certifications. Upon completion of USAARL test, a technical data package is developed for submission to Naval Air Systems Command.

MARCORSYSCOM has employed this process for the evaluation of the En Route Care equipment set. This process was established to provide a rigorous process for evaluating technology/equipment effectiveness and operating environment standards.

Navy Combat Development Process. Under the ideal situation, The Naval Warfare Development Command develops process used for recommending alignment of war-fighting requirements and programs to achieve the best capability within resources. Current capability development is conducted through two avenues: (1) if the technology requires “proof of

concept,” the technology will mature through the SEA TRIAL process; and (2) if the technology has passed its proof of concept tests, it will move through JCIDS.

SEA TRIAL. The Commander, US Fleet Forces Command, is designated as Lead Agent for the SEA TRIAL process. SEA TRIAL is described in the Naval Transformation Roadmap as the “process for formulating and testing innovative operational concepts, most of which harness advanced technologies and are often combined with new organizational configurations, in pursuit of dramatic improvements in war fighting effectiveness.” This process is based on the mutually reinforcing mechanisms of technology push, concept pull, and spiral development, integrated into an enduring process for transformation.¹⁴⁻¹⁸ Further, this process puts the Fleet at the heart of innovation and provides a mechanism to more readily capture the fruits of their operational excellence and experimentation. At its core is a comprehensive SEA TRIAL, concept development and experimentation (CD&E) to rapidly mature new concepts, technologies and doctrine. This plan lays out the Navy’s approach to CD&E within the framework of SEA TRIAL, and supports the accomplishment of Navy’s transformational roles and responsibilities. SEA TRIAL will provide the venue to determine technology proof of concept. The following link describes the flow through SEA Trial and JCIDS.

(<http://www.nwdc.navy.mil/STIMS/documents/CFFCsTrialInst.pdf>).

Joint Capabilities Integration and Development System (JCIDS). JCIDS ensures the joint forces have the capabilities necessary to perform across the range of military operations and challenges. Recent operations have emphasized the necessity of integrated and interoperable joint war-fighting capabilities. A joint concepts-centric capabilities identification process is required to define how new joint capabilities are identified and developed. JCIDS implements an integrated collaborative process to guide development of new capabilities through changes in joint doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) and policy. For all potential materiel and nonmateriel solutions, human solution interface impacts and constraints must be assessed as part of the DOTMLPF analysis. Change recommendations are developed, evaluated, and prioritized based on their contribution to future joint operations.

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Appendix A: Tech Watch System Requirements Documentation

Objective

The objective of this document is to outline the system requirements and identify the expected software functionality of the Tech Watch application.

Scope

This *Tech Watch Requirements Analysis* documents the needs, expectations, and understanding of the Tech Watch product and provides a framework for identifying, planning, testing, and evaluation. New requirements may be identified and managed under change control procedures.

Historical Profile

In the past, organizations employed newspaper clipping services to stay informed of new and current topics. These services subscribed to newspapers, magazines and trade journals and literally clipped articles of interest to the client and placed them in folders for the client's review. With the advent of electronic mail and the internet, these services have become obsolete. Instantaneous news delivery via electronic media has created a wealth of information freely available on nearly all topics.

Information Brokerages, such as Dialog and Knight-Ridder Press, allowed fee-based direct access to news wire services to obtain breaking news on keywords and search topics. These "alert" services were expensive, and the results included onerous articles where keywords and/or search terms had multiple meanings. For instance, a search for NHRC would return results containing articles on

- Naval Health Research Center
- NASA Houston Rocket Club
- National Human Rights Commission
- National Housing Research Committee

(based upon a recent Web search for NHRC as a search topic)

The quality of the result is totally dependent upon the skill of the searcher and their ability to draft specific search terms to filter to those articles with the desired content. The two main issues facing an organization seeking to use the internet as a means of replacing news clipping services are pertinence of the information returned, and the tremendous amount of information to be sifted. Tech Watch will fill this void by using

keyword lists and filtering mechanisms to automatically route news articles to key decision makers within NHRC, informing them of new technologies and trends, which will affect military operations in the near future. Semantic statistics will be used to filter articles based on their *meaning and content*, rather than keywords alone.

Current Functions

Currently, personnel subscribe to newspapers, magazines and trade journals and read items of personal interest. Some of these news sources may have online equivalents, which allow news forwarding to other interested parties. Some sites, such as Yahoo and Google, have personalized home pages, which allow the aggregation of multiple news sources on a specific topic to be tracked on a daily basis.

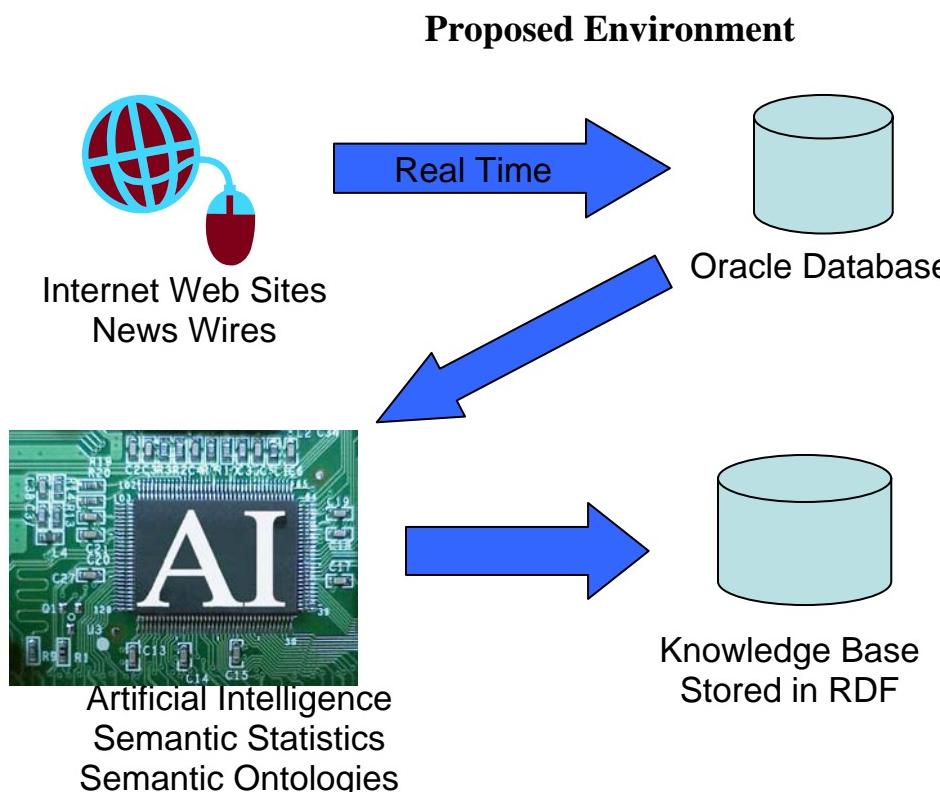
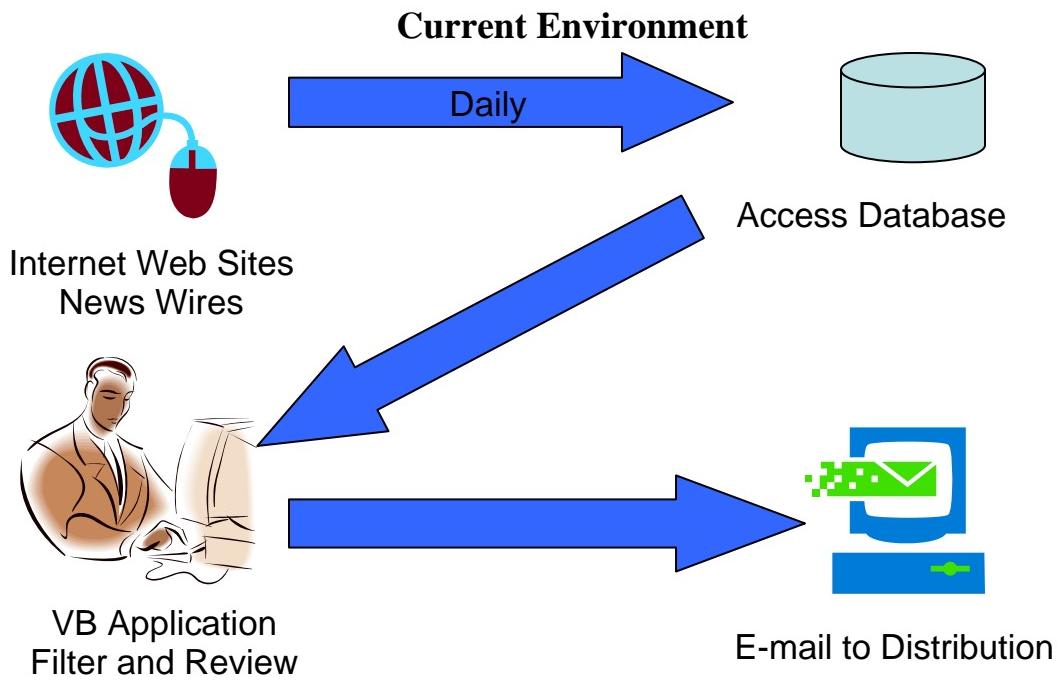
Enormous effort must be expended to remain current in the fields of nanotechnology, biotechnology, artificial intelligence, wireless communications, security, encryption, Web mining, medical diagnostics, medical equipment and medical procedures just to name a few. Tech Watch will provide breaking news on these technologies directly to decision makers. Ultimately Tech Watch will also provide a state-of-the-art search capability for currently available COTS/GOTS products.

Component or System Description

Currently, Tech Watch is running in a prototype environment using E-mail, PERL, Visual Basic and Microsoft Access and MySQL. The product will be migrated to a Web-based portal environment, using Java and Oracle to deliver a scalable, interactive research tool for NHRC use.

Deficiencies

The current system is not scalable, and requires extensive filtering by a human operator to eliminate redundant and extraneous articles. Over 400 individual Web sites are perused on a daily basis to identify new technologies and trends, which may affect military endeavors in the near future. Users cannot directly input new search topics, and new technologies & trends are not automatically recognized.



Requirements

This section states the functions required of the Tech Watch application in quantitative and qualitative terms where applicable, and describes the operational requirements needed to fulfill the end user's expectations.

Goals

Tech Watch seeks to provide the ability to track new technologies and trends, and store relevant articles in a fashion, which is easily queried and accessed. Each article will have associated discussion(s) regarding the application and possible use of the technology for NHRC interests.

Data Requirements

Information collected shall be news articles from the Internet, stored in resource description framework (RDF) format. Semantic Statistics and Ontologies will be stored using the Ontological Web Language (OWL). The OWL is designed for use by applications that need to process the content of information instead of just presenting information to humans. OWL facilitates greater machine interpretability of Web content than that supported by XML, RDF, and RDF Schema (RDF-S) by providing additional vocabulary along with a formal semantics. OWL has three increasingly expressive sublanguages: OWL Lite, OWL DL, and OWL Full.

OWL is a precursor to a form of the internet named the “Semantic Web”. It seeks to provide a framework where the knowledge of semantics and language can be used to categorize meaning and content of articles.

Input and Output Requirements

The following subsections describe the input and output requirements of the TECHWATCH application.

Input Requirements – User Interface

The Tech Watch application shall accept user input via a secure internet site. The interface will allow the user to search for keywords and categories, and limit the results by date range or category. The user will also be able to participate in discussion regarding the articles, and see related threads and comments from other users.

Input Requirements – Application

The Tech Watch application will be designed to quickly cull information from the multitudes of internet Web sites; RSS and ATOM sites and direct news wires to find articles based upon keyword and category searches. These search results will be filtered in an attempt to limit the number of extraneous material.

The results of the search will be ranked and placed in a relational database for retention and searches via the User Interface.

Output Requirements

The Tech Watch application shall allow the user to forward articles to outside e-mail addresses for the purposes of coordination and sharing of important concepts and background. Subsequent versions of the application may add ability to forward links to COTS/GOTS products, for instance, in addition to news articles.

Functional Requirements

The Tech Watch application shall have functions that allow users to both interactively search articles for new topics and technologies, and also set up automated alerts when new articles appear within a specific category/subcategory.

The discussion portion of the application will allow the free exchange of ideas and concepts relating to the possible use of new technologies within military endeavors.

Database Table Management

The Tech Watch application requires the administration of tables, which drive the application. Each of these tables will have an administrative screen, which provides the administrator the ability to

- Create new records
- Retrieve existing records
- Update and change existing records
- Delete records

The initial tables that require administration and their descriptions are listed below.

1. Articles – This table is the primary storage location for news articles pertinent to Tech Watch. The table has a full text index, which allows searching title and article body.
2. Dictionary – a list of keywords for Tech Watch to follow, along with the Google search expression for a particular keyword.

3. Headlines – Source, date, headline and summary of articles retrieved via Google news service.
4. Key Lookup – A list of keywords found for each unique article. An article may contain multiple keywords. Each keyword found has a statistical ranking for its search results.

Performance Requirements

The Tech Watch application shall be designed and developed using COTS and GOTS hardware and software. The selection of this hardware and software shall be confined by the products of the market and based on their ability to meet the various functional requirements of the system.

Presently, there are no specific performance requirements established regarding data storage capacity, length of continual operation, speed of operation, or periods of availability; however, the Tech Watch Project Team shall continue to investigate possible performance requirements through perspective end-user and client feedback.

Systems and Communication Requirements

Presently, there are no specific systems or communications requirements for the TECH WATCH application. The TECH WATCH Project Team shall continue to investigate possible requirements through perspective end-user and client feedback.

System Security Requirements

The Tech Watch application shall require capabilities to limit access to validated users, and to capture timestamp information for user interactions with the system. Authorized access to this application shall be implemented using a username and password login procedure.

Backup and Recovery Requirements

The Tech Watch Project Team shall ensure that the application provides capabilities that conform to standard Naval data backup and recovery processes and/or Government guidelines provided by the client. Any system-related documentation shall include information outlining any recommended backup and recovery procedures.

Support Considerations

The Tech Watch Project Team shall provide all logistics support and training required for the Tech Watch application for the contracted period of performance. This support shall include planning for maintenance and repair on the Tech Watch application and associated

devices, (e.g., server, workstations) and the acquisition of miscellaneous spare and repair parts, and repair services, as deemed necessary by the Tech Watch Project Team.

Hardware Requirements

The following subsections describe the hardware functionality and characteristics of the Tech Watch application.

Hardware Functionality

The Tech Watch hardware shall support the software demands inherent to the Tech Watch application concept. It shall have sufficient processing speed and memory to accommodate the required data entry, retrieval, and transfer capabilities associated with the goals of the Tech Watch development effort.

Hardware Characteristics

The Tech Watch application shall include hardware capable of operating within the intended physical operational environments. Consideration shall be given to portability, size, weight, battery life, accessories, display quality, and resistance to environmental factors such as dust, moisture, temperature, and shock. Computer processing speed and memory shall support the functionality of the developed software. The Tech Watch application shall include a touch-screen display and/or keyboard. All of the above-listed attributes shall be dependent on the constraints found within available COTS/GOTS products.

Software Requirements

The following subsections describe the software functionality and characteristics of the Tech Watch application.

Software Functionality

The Tech Watch application shall be hosted on a Win XP computer system, with the ability to connect to a relational database server and the Internet. The user interface will be browser based.

Software Characteristics

The Tech Watch application's software shall be written to adhere to the MTS Coding Standards employed for all previous NHRC projects. The software shall be quality tested by the Tech Watch Project Team to ensure consistent, repeatable functionality. To ensure ease of maintenance, the Tech Watch Project Team shall use current, widely used, and industry-accepted software development tools and practices.

Usability Requirements

Presently, there are no specific usability requirements for the Tech Watch application, which are above and beyond the standard requirements for a Web-based application delivery. The Tech Watch Project Team shall continue to investigate possible requirements through perspective end-user and client feedback.

Site Adaptation Requirements

The Tech Watch application shall be completely installable from a CD or downloadable file, and shall not require any site adaptation procedures.

Apportioning of Requirements

Future releases of the Tech Watch application may incorporate additional search and data filtration techniques.

Technical Requirements

The Tech Watch application shall be capable of running on machines using Windows XP with little or no customization needed.

Design Constraints

Design constraints of the Tech Watch application are as follows:

- The design is dependent on available COTS/GOTS products; therefore, the design of the application is limited to the current state of technology.
- The Tech Watch Project Team shall investigate compliance to Federal Information Processing Standards Information Technology-21 (IT-21), and other government/Department of Defense (DOD) directives pertaining to the use of selected computing devices. Compliance may require the use of specialized government equipment and/or algorithms that may not be available to the Tech Watch Project Team.

Appendix B: Tech Watch System Requirements

Introduction

This document describes the software architecture of the Tech Watch application developed for NHRC, the structure of the components of the system, their interrelationships, and principles and guidelines governing their design and evolution over time.

Project Overview

The Tech Watch project seeks to create an automated news clipping service to be searched by specific keywords users may find relevant to new technology and techniques within the medical and military domains. Users may be military medical personnel, professionals and researchers working in military medicine.

Input

The input for the Tech Watch application will be delivered from three primary source types:

- Subscription newsletters (both electronic and paper)
- Online Web sites devoted to technology and medical news
- News wires services delivered via Google

Stories and articles derived from these sources will be perused on a daily basis for items matching keywords stored within a database. News items matching the keywords will be stored within the database for retrieval and review by users. Copyright issues for articles captured will be pursued by requesting authorization from users or the article will be temporarily stored pending authorization. Alternatively some major university libraries such as Stanford could host the articles. These libraries contact the publisher/author and request permission to host them before they are stored electronically. NHRC would need to pursue such an agreement and determine costs. Future versions of the application can include additional inputs such as from National Institutes of Health database of developmental projects (Computer Retrieval of Information on Scientific Projects - CRISP).

Database

The database will be a relational database capable of scaling to thousands of simultaneous connections and offering full text search capabilities. The database consists of four tables and associated indices. The four tables are named Articles, Dictionary, Headlines

and KeyLookup. Table descriptions are listed below. Prior to deployment, the application will also need have security tables (Users, permissions, etc.) added to the schema.

Articles Schema

Field	Type	Null	Key	Default	Extra
ArticleID	int(11)	(null)	PRI		auto_increment
PubDate	Datetime	YES	(null)		(null)
Title	varchar(200)	YES	MUL		(null)
Body	Text	YES	(null)		(null)
Sent	char(1)	YES	(null)	N	(null)
URL	varchar(200)	YES	(null)	(null)	(null)

Field Descriptions

- ArticleID – a unique identifier for each new article within the database.
- PubDate – the date when the article was entered into the database.
- Title – the title of the article.
- Body – the text (either ASCII or HTML) of the article including authors if available.
- Sent – a Boolean flag (Yes or No), which tracks the e-mail status for this specific article.
- URL – the Uniform Resource Location (URL) of the article’s source. This field is usually a Web page location, but can also be the print edition bibliographic information.

The Articles table comprises the entire body of the articles placed within Tech Watch.

Based upon the number of keywords and article frequency, the table could grow quite large. At present, no automated archival process exists to “age” articles to a backup, offline or file system data source.

Dictionary Schema

Field	Type	Null	Key	Default	Extra
SubCategory	varchar(50)	YES	MUL		(null)
Category	varchar(50)	YES	(null)		(null)
GoogleTerm	varchar(90)	YES	(null)		(null)

Field Descriptions

- Category – the main category or heading used to group the keyword definition. The Category name is used during processing to build HTML documents from the Google news wire stories. An example is “Artificial Intelligence”. All of the subcategories/keywords within Artificial Intelligence will be combined into single HTML document to review Google news stories.
- SubCategory – the specific keyword used to define an interesting article. An example is “Neural Network”. So the formal Category/Subcategory would be Artificial Intelligence – Neural Networks for one keyword entry.
- Google Term – the Google-specific search syntax used to extract news stories for this keyword. Several keyword entries may be combined into one Google search term – Nano* finds all articles related to nanotechnology, nanoshells, nanospheres and nanoscale. The entries for the remaining combined fields will be blank if this search term encompasses them also.

Headlines Schema

Field	Type	Null	Key	Default	Extra
Category	varchar(50)	YES	(null)		(null)
ArtDate	Datetime	YES	(null)		(null)
Headline	varchar(100)	(null)	PRI	(null)	(null)
Source	varchar(200)	YES	(null)		(null)
URL	varchar(200)	YES	(null)		(null)
Subcategory	varchar(50)	YES	(null)		(null)
NewStory	char(1)	YES	(null)		(null)

Field Descriptions

- Category – matches the Category column within the Dictionary table.
- Subcategory – matches the Subcategory column within the Dictionary table.
- ArtDate – the date the story appeared on the Google news wire.
- Headline – performs the same function as the Title column in the Article table.
- URL – performs the same function as the URL column in the Article table.
- Source – the news wire source (i.e. United Press Intl, Associated Press Intl, etc.).

- NewStory – a Boolean flag to track if this story has been reported via the Tech Watch application or not.

KeyLookup Schema

Field	Type	Null	Key	Default	Extra
ArticleID	int(11)	YES	(null)	(null)	
Subcategory	varchar(50)	YES	(null)	(null)	
Score	double(10,4)	YES	(null)	(null)	
Category	varchar(50)	YES	(null)	(null)	

Field Descriptions

- ArticleID – matches the ArticleID column within the Article table.
- Category – matches the Category column within the Dictionary table.
- Subcategory – matches the Subcategory column within the Dictionary table.
- Score – the relevance score for this keyword/subcategory
- (e.g., may be calculated by using a MATCH function against the article title and body.)
Low relevance scores (< 1.5) are not stored within the database and are considered extraneous.

Output

The Tech Watch application will provide the ability to search and retrieve relevant news articles, and export these stories to a variety of formats including e-mail, RSS, Atom, HTML, XML, RDF and text. The application itself will be Web-based, with the following actions available:

Main Menu

Search for Articles based on keyword

 Filter resulting articles based upon date range

Search Google News for a new keyword

 Filter resulting articles based upon date range

Browse Articles based on Category/Subcategory

 Filter resulting articles based upon date range

Request to add keyword and category to automated tracking system

 E-mail confirmation when automated keyword search is added

Request e-mail notification when a new article appears with a particular keyword

E-mail confirmation when automated notification is added

Maintenance

Administratate Articles table

Retrieve and update new records

Delete erroneous records

Administratate Dictionary table

Create new records

Retrieve and update new records

Delete erroneous records

Administratate Headlines table

Create new records

Retrieve and update new records

Delete erroneous records

Administratate KeyLookup table

Create new records

Retrieve and update new records

Delete erroneous records

Reports

Count of articles and e-mail notifications by Category

Count of articles and e-mail notifications by Category/Subcategory

Count of articles and e-mail notifications by E-mail address

User Administration

To Be Determined

Processing and Utilities

The Tech Watch application requires several external processes and utilities to accomplish its functions. These are listed and described below.

WebSite-Watcher

A COTS software package to track updates and changes on multiple Web pages. Changes to the Web page are outlined in yellow, allowing new items to be easily distinguished from older portions of the Web page. The software can be purchased at www.aignes.com. This

tool is used to monitor approximately 400 Web pages dealing with military, technology and medical news on a daily basis.

IndigoMail

This COTS program provides the functionality of the SENDMAIL program to non-UNIX environments. The program is utilized by the SendEMail script to send automated batches of e-mail with new stories. The software can be purchased from IndigoStar at www.indigostar.com

GoogleNews2.pl

This is an in-house developed Perl script, which is dependent on many third-party freeware modules, such as WWW::Google::News. As such, this script requires maintenance from time-to-time. This script performs several automated functions:

- Removes any articles from the Headlines table which are more than 5 days old
- Reads the Dictionary table for Google search terms
- Uses the Google News API to query for 3 days of news per search term
- Reviews the Headlines table to see if this article (based upon title) has already appeared within Tech Watch
- If the article title is new, the program creates a new Headline table record for this article.
- The program adds title, URL and brief synopsis of the article to an HTML document for this Category.

CreateRankings.pl

This is an in-house developed Perl script, which populates the KeyLookup table by:

- Erasing all table entries. This is necessary when new keywords are added.
- Read the Dictionary table for all possible keywords and search terms.
- For each search term, use the MATCH query to find the relevance score for this search term.
- If the relevance value is greater than 1.5, create a new record in KeyLoop for this particular keyword + article combination.

SendEmail.pl

This is an in-house developed Perl script, which sends the automated daily updates of new articles.

- Scanning the Articles table for any articles where NewArticle flag is “Yes”.

- Creating an e-mail header information for the distribution list.
- Creating an e-mail body from the article record.
- Send the article via e-mail to the distribution list using an SMTP server.
- Mark the article as sent, by setting the NewArticle flag to “No”.

Architectural Style

The Tech Watch application is based upon a simple Web-based development environment. The database server and Web server will be centralized for maintenance and security. The end-users will use Web browsers to manipulate and research information.

Architectural Goals and Constraints

The goals and constraints applicable to the architecture of the Tech Watch application are listed below.

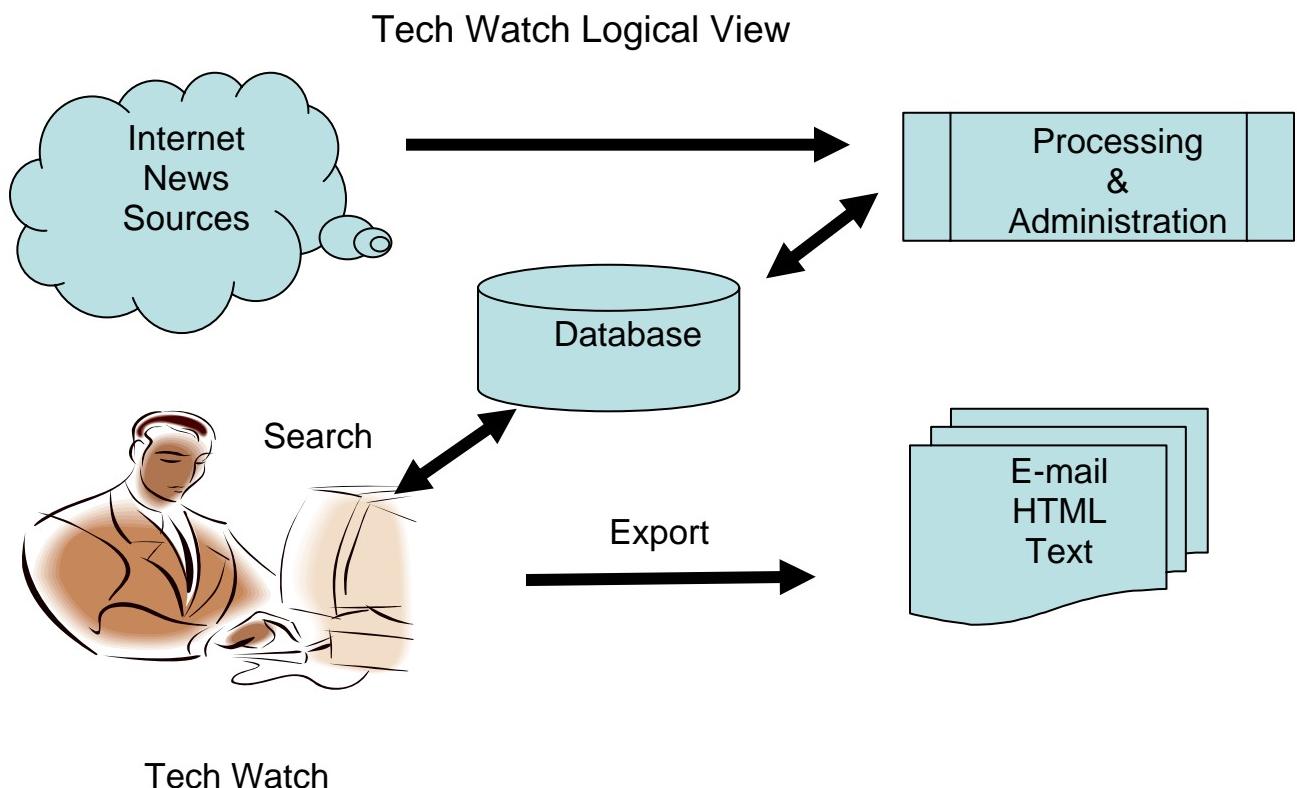
The architecture is intended to identify the major structural elements of the software, as well as the interfaces provided by those elements to allow for use by other elements.

Tech Watch uses keyword searches to identify news articles from one source (Google), and manual techniques to import data from other data sources such as vendor Web sites. The automated searches will require update and changes each time Google elects to change their application program interface (API) to the Google News service.

Keyword searches are not the best method of filtering technical material from internet sources, but are relatively simple to implement. As the Tech Watch application grows in both size and breadth, a more sophisticated search/filter mechanism such as latent semantic indexing or semantic ontologies will be required.

Logical View

The functionality for the Tech Watch Web-based application is illustrated below.



Tech Watch

Module View

The software modules and scripts for the Tech Watch application were discussed previously. These functions will be evaluated during the conversion to a comprehensive Java program utility and segregated for ease of maintenance and functionality.

Physical View

Since the Tech Watch application employs a simple Web-based delivery, the physical view was not developed. The centralized applications running on the server will include the database, Java utilities and Web server. The client will be a simple browser-based connection.

Use Cases

No Use Cases were developed for the Tech Watch application.

Size and Performance

There are no requirements pertinent to the Tech Watch application for either size or performance issues.

Quality

The Tech Watch application uses several services which have been available less than 1 year (Google News API, for instance). The quality of the articles using this interface is entirely dependent upon the search terms used, and still requires some manual intervention when new terms and/or terminology are added or updated.

REPORT DOCUMENTATION PAGE

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB Control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

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12 DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT (maximum 200 words)

The present study objectives were to (1) develop an informational "tech watch" website and/or service for Navy Medicine that tracks commercial-off-the-shelf (COTS)/government-off-the-shelf (GOTS) medical technologies, and (2) integrate the Tech Watch service with relevant Navy entities, such as the Fleet Forces Command (FFC) and Naval Warfare Development Command.

A concepts of operations (CONOPS) included four components: (1) gathering information based on keyword inputs to an Internet search engine, (2) filtering the information for relevance and duplication, (3) reporting results to relevant users, and (4) extending the service to include new keywords and technologies based on user feedback. A prototype Internet search tool and database were developed.

Additional work would develop a Web-based interface, user database, and use of artificial intelligence methods to permit semantic search and filtering capabilities. The combat development process for Navy medical requirements is still under development at FFC; therefore, integration of the NHRC Tech Watch service is pending. The utility of similar efforts, such as the Office of Naval Research Tech Solutions project, a Web-based solution for collecting and responding to nonmedical technology requests, suggests that a similar medical effort such as NHRC's Tech Watch project would add value to the development of military medical technology.

15. SUBJECT TERMS

Navy Medical Technology, Tech Watch, COTS, GOTS

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